1. Suppose that you are planning an experiment with 40 subjects per group. Assuming that
the data is normally distributed with standard deviation 2 in both groups, use simulation to
approximate the power of a study design that specifies the use of the Wilcoxon rank sum test
to test for differences between the 2 groups if the mean in one group is 1 and the mean in the
other group is 2. Compare this to using the 2 sample \( t \)-test with equal variance.

2. Problem 4.2 from Foulkes text

3. Problem 4.3 from Foulkes text

4. Problem 4.6 from Foulkes text

5. Problem 4.7 from Foulkes text

6. Independently simulate binary indicator variables for 2000 markers for 100 subjects with suc-
cess probability 0.5. For each subject simulate a normally distributed outcome variable that
depends on the first 10 markers with regression coefficients of 10, 9, \ldots , 1 and has standard
deviation 1. For each marker, use a 2 sample \( t \)-test with equal variance to test if the marker
is associated with the trait. Make a histogram of the resulting set of \( p \)-values and compute
a \( q \)-value for each marker. If we control the FDR using the default options in the \texttt{qvalue}
function what is the proportion of false positives and true positives that you observe?

7. Simulate 100 independent observations from a normal distribution with mean zero and stan-
dard deviation 1 and 50 independent observations from a normal distribution with mean 3 and
standard deviation 0.5 (use the command \texttt{set.seed(1)} first). Combine the 2 samples into
one sample and make a histogram (this is a plot of a \textit{mixture model} distribution). Use the
bootstrap to obtain a confidence interval for the standard deviation of this distribution.